

IN THE CLAIMS:

Please write the claims to read as follows:

- 1 1. (Previously Presented) A system for replay of a backup memory in a storage system
2 having a file system for managing transfer of data to and from an attached disk array, the
3 system comprising:
4 a log in the backup memory containing the storage system transaction entries ac-
5 cumulated after a consistency point at which time results of the storage system transac-
6 tion entries are committed to the disk array;
7 an initiator process that establishes a swarm of messages with respect to the stor-
8 age system transaction entries and delivers the swarm to the file system; and
9 a disk information-retrieval process in the file system that is carried out on the
10 swarm of messages in parallel.
- 1 2. (Original) The system as set forth in claim 1 wherein each of the messages of the
2 swarm is identified by a transaction block including a pointer to one of the transaction
3 request entries in the log, respectively, and a state that indicates whether each of the mes-
4 sages is one of (a) newly transferred to the file system, (b) subject to completion of a
5 LOAD phase thereon by the disk information-retrieval process, (c) subject to completion
6 of a MODIFY phase thereon by a MODIFY process of the file system or (d) incapable of
7 being subject to the LOAD phase until a prerequisite event occurs.
- 1 3. (Original) The system as set forth in claim 2 wherein the prerequisite event is com-
2 pletion of the LOAD phase and a MODIFY phase with respect to another of the mes-
3 sages.

1 4. (Original) The system as set forth in claim 3 wherein the initiator process is adapted
2 to retransfer each of the messages incapable of being subject to a load phase until the pre-
3 requisite event occurs to the file system for completion of the LOAD phase after the pre-
4 requisite event occurs, respectively.

1 5. (Original) The system as set forth in claim 4 wherein the initiator is adapted to estab-
2 lish a skip state with respect to skipped messages for which a portion of the disk array
3 associated therewith is unavailable, the skip state thereby omitting the skipped messages
4 from the swarm.

1 6. (Original) The system as set forth in claim 4 wherein the file system includes a panic
2 state adapted to alert an operator if a first message received from the initiator in the
3 swarm is a message incapable of being subject to a load phase until a prerequisite event
4 occurs.

1 7. (Original) The system as set forth in claim 4 wherein the file system includes a panic
2 state adapted to alert an operator if a message retransferred by the initiator process is a
3 message incapable of being subject to a load phase until a prerequisite event occurs.

1 8. (Original) The system as set forth in claim 1 wherein the backup memory comprises
2 a non-volatile random access memory (NVRAM).

1 9. (Original) The system as set forth in claim 1 wherein the storage system comprises a
2 network storage appliance.

1 10. (Original) A method for replay of a backup memory in a storage system having a file
2 system for managing transfer of data to and from an attached disk array, the method
3 comprising:

4 accumulating, in a log in the backup memory, storage system transaction request
5 entries after a consistency point at which time results of the transaction request entries are
6 committed to the disk array;
7 establishing a swarm of messages with respect to the transaction request entries
8 and delivering the swarm to the file system; and
9 performing a disk information-retrieval process of the file system on the swarm of
10 messages in parallel.

1 11. (Original) The method as set forth in claim 10 further comprising establishing, for
2 each of the messages of the swarm, a transaction block including a pointer to one of the
3 transaction request entries in the log, respectively, and a state that indicates whether each
4 of the messages is one of (a) newly transferred to the file system, (b) subject to comple-
5 tion of a LOAD phase thereon by the disk information-retrieval process, (c) subject to
6 completion of a MODIFY phase thereon by a MODIFY process of the file system or (d)
7 incapable of being subject to the LOAD phase until a prerequisite event occurs.

1 12. (Original) The method as set forth in claim 11 wherein the prerequisite event is com-
2 pletion of the LOAD phase and a MODIFY phase with respect to another of the mes-
3 sages.

1 13. (Original) The method as set forth in claim 12 further comprising retransferring each
2 of the messages incapable of being subject to a load phase until the prerequisite event oc-
3 curs to the file system for completion of the LOAD phase after the prerequisite event oc-
4 curs, respectively.

1 14. (Original) The method as set forth in claim 10 wherein the storage system comprises
2 a network storage appliance.

1 15. (Original) A computer-readable medium including program instructions executing on
2 a computer for parallelized replay of a backup memory in a storage system having a file
3 system for managing transfer of data to and from an attached disk array, the program in-
4 structions performing the steps of:

5 accumulating, in a log in the backup memory, storage system transaction request
6 entries after a consistency point at which results of the transaction request entries are
7 committed to the disk array;

8 establishing a swarm of messages with respect to the transaction request entries
9 and delivering the swarm to the file system; and

10 performing a disk information-retrieval process of the file system on the swarm of
11 messages in parallel.

1 16. (Original) The computer-readable medium as set forth in claim 15 further comprising
2 establishing, for each of the messages of the swarm, a transaction block including a
3 pointer to one of the transaction request entries in the log, respectively, in the log and a
4 state that indicates whether each of the messages is one of (a) newly transferred to the file
5 system, (b) subject to completion of the LOAD phase thereon by the disk information-
6 retrieval process, (c) subject to completion of a MODIFY phase thereon by a MODIFY
7 process of the file system or (d) incapable of being subject to the LOAD phase until a
8 prerequisite event occurs.

1 17. (Original) The computer-readable medium as set forth in claim 16 wherein the pre-
2 requisite event is completion of the LOAD phase and a MODIFY phase with respect to
3 another of the messages.

1 18. (Original) The computer-readable medium as set forth in claim 17 further comprising
2 retransferring each of the messages incapable of being subject to a load phase until the
3 prerequisite event occurs to the file system for completion of the LOAD phase after the
4 prerequisite event occurs, respectively.

1 19. (Original) The computer-readable medium as set forth in claim 15 wherein the stor-
2 age system comprises a network storage appliance.

1 20. (Previously Presented) An apparatus for replay of a backup memory in a storage sys-
2 tem having a file system for managing transfer of data to and from an attached disk array,
3 comprising:

4 a processor to determine a consistency point in time, said apparatus containing at
5 least one transaction entry accumulated after the consistency point, where at the time of
6 the consistency point the transaction entries are committed to the disk array;

7 a plurality of messages, each message of said plurality of messages being related
8 to a transaction entry of said transaction entries accumulated after the consistency point,
9 said plurality of messages being referred to as a swarm of messages;

10 an initiator process to deliver the swarm of messages to the file system; and

11 a disk information-retrieval process that processes the swarm of messages in par-
12 allel.

1 21. (Previously Presented) The apparatus as set forth in claim 20, further comprising:

2 each of the messages of the swarm is identified by a transaction block including a
3 pointer to one of the transaction request entries.

1 22. (Previously Presented) The apparatus as set for in claim 20, further comprising:

2 a state that indicates whether each of the messages is one of

3 (a) newly transferred to the file system,

4 (b) subject to completion of a LOAD phase thereon by the disk informa-
5 tion-retrieval process,

6 (c) subject to completion of a MODIFY phase thereon by a MODIFY pro-
7 cess of the file system, or

8 (d) incapable of being subject to the LOAD phase until a prerequisite
9 event occurs.

1 23. (Previously Presented) The apparatus as set forth in claim 22, further comprising:
2 the prerequisite event is completion of the LOAD phase and a MODIFY phase
3 with respect to another of the messages.

1 24. (Previously Presented) The apparatus as set forth in claim 23, further comprising:
2 the initiator process is adapted to retransfer each of the messages incapable of be-
3 ing subject to a load phase until the prerequisite event occurs to the file system for com-
4 pletion of the LOAD phase after the prerequisite event occurs, respectively.

1 25. (Previously Presented) The apparatus as set forth in claim 20, further comprising:
2 the initiator is adapted to establish a skip state with respect to skipped messages
3 for which a portion of the disk array associated therewith is unavailable, the skip state
4 thereby omitting the skipped messages from the swarm.

1 26. (Previously Presented) A method for replay of a backup memory in a storage system
2 having a file system for managing transfer of data to and from an attached disk array, the
3 method comprising:
4 accumulating one or more transaction request entries after a consistency point,
5 said consistency point is a time at which results of the transaction request entries are
6 committed to the disk array;
7 establishing a plurality of messages with respect to the transaction request entries,
8 said plurality of messages being referred to as a swarm of messages and delivering the
9 swarm to the file system; and
10 executing a disk information-retrieval process on the swarm of messages in paral-
11 lel.

1 27. (Previously Presented) The method as set forth in claim 26, further comprising:
2 establishing, for each of the messages of the swarm, a transaction block including
3 a pointer to one of the transaction request entries in the log.

1 28. (Previously Presented) The method as set forth in claim 20, further comprising:
2 establishing a state that indicates whether each of the messages is one of
3 (a) newly transferred to the file system,
4 (b) subject to completion of a LOAD phase thereon by the disk informa-
5 tion-retrieval process,
6 (c) subject to completion of a MODIFY phase thereon by a MODIFY pro-
7 cess of the file system, or
8 (d) incapable of being subject to the LOAD phase until a prerequisite
9 event occurs.

1 29. (Previously Presented) The method as set forth in claim 28, further comprising:
2 using as the prerequisite event completion of the LOAD phase and a MODIFY
3 phase with respect to another of the messages.

1 30. (Previously Presented) The method as set forth in claim 29, further comprising:
2 retransferring each of the messages incapable of being subject to a load phase un-
3 til the prerequisite event occurs to the file system for completion of the LOAD phase af-
4 ter the prerequisite event occurs.

1 31. (Previously Presented) An apparatus for replay of a backup memory in a storage sys-
2 tem having a file system for managing transfer of data to and from an attached disk array,
3 comprising:
4 means for accumulating, a transaction request entry after a consistency point, said
5 consistency point is a time at which results of the transaction request entries are commit-
6 ted to the disk array;

7 means for establishing a plurality of messages with respect to the transaction re-
8 quest entries, said plurality of messages being referred to as a swarm of messages and
9 delivering the swarm to the file system; and
10 means for processing a disk information-retrieval process of the file system on the
11 swarm of messages in parallel.

1 32. (Previously Presented) The apparatus as set forth in claim 31, further comprising:
2 means for establishing, for each of the messages of the swarm, a transaction block
3 including a pointer to one of the transaction request entries in the log.

1 33. (Previously Presented) The apparatus as set forth in claim 32, further comprising:
2 means for establishing a state that indicates whether each of the messages is one
3 of
4 (a) newly transferred to the file system,
5 (b) subject to completion of a LOAD phase thereon by the disk informa-
6 tion-retrieval process,
7 (c) subject to completion of a MODIFY phase thereon by a MODIFY pro-
8 cess of the file system, or
9 (d) incapable of being subject to the LOAD phase until a prerequisite
10 event occurs.

1 34. (Previously Presented) The apparatus as set forth in claim 33, further comprising:
2 means for using as the prerequisite event completion of the LOAD phase and a
3 MODIFY phase with respect to another of the messages.

1 35. (Previously Presented) The apparatus as set forth in claim 34, further comprising:
2 means for retransferring each of the messages incapable of being subject to a load
3 phase until the prerequisite event occurs to the file system for completion of the LOAD
4 phase after the prerequisite event occurs.

1 36. (Previously Presented) A computer readable media, comprising:
2 said computer readable media having instructions written thereon for execution on
3 a processor for the practice of the method of claim 10 or claim 26.

1 37. (Previously Presented) Electromagnetic signals propagating on a computer network,
2 comprising:
3 said electromagnetic signals carrying instructions for execution on a processor for
4 the practice of the method of claim 10 or 26.

1 38. (Previously Presented) The system of claim 1, further comprising:
2 a third process that modifies at least some messages in the swarm of messages
3 based on the order in which storage system transaction entries were stored in the log.

1 39. (Previously Presented) The method of claim 10, further comprising:
2 modifying at least some messages in the swarm of messages based on the order in
3 which storage system transaction request entries were accumulated in the log.

1 40. (Previously Presented) The method of claim 26, further comprising:
2 modifying at least some messages in the swarm of messages based on the order in
3 which transaction request entries were accumulated in the log.

1 41. (Previously Presented) A file system, comprising:
2 a backup memory storing a plurality of file system transaction entries;

3 a first process that establishes a swarm of messages with respect to the file system
4 transaction entries and delivers the swarm of messages to the file system;

5 a second process that performs a LOAD phase in a concurrent manner for a plu-
6 rality of messages in the swarm of messages; and

7 a third process that performs a MODIFY phase for at least some messages in the
8 swarm of messages, the MODIFY phase operating on messages based on the order in
9 which file system transaction entries were stored in the backup memory.

1 42. (Previously Presented) The file system of claim 41, further comprising:

2 a fourth process that determines whether a file system transaction entry corre-
3 sponds to a file system transaction that can be performed right away.

1 43. (Previously Presented) The file system of claim 42, wherein the fourth process,
2 in response to determining that the file system transaction can not be performed right
3 away, associates the file system transaction entry with a LOAD RETRY state until a prior
4 prerequisite transaction is performed.

1 44. (Previously Presented) A method, comprising:

2 storing a plurality of file system transaction entries in a backup memory;
3 establishing a swarm of messages with respect to the file system transac-
4 tion entries;

5 delivering the swarm of messages to a file system;

6 performing a LOAD phase in a concurrent manner for a plurality of mes-
7 sages in the swarm of messages; and

8 performing a MODIFY phase for at least some messages in the swarm of
9 messages, the MODIFY phase operating on messages based on the order in which
10 file system transaction entries were stored in the backup memory.

1 45. (Previously Presented) A system, comprising:

2 means for storing a plurality of file system transaction entries in a backup
3 memory;

4 means for establishing a swarm of messages with respect to the file system
5 transaction entries;

6 means for delivering the swarm of messages to a file system;

7 means for performing a LOAD phase in a concurrent manner for a plural-
8 ity of messages in the swarm of messages; and

9 means for performing a MODIFY phase for at least some messages in the
10 swarm of messages, the MODIFY phase operating on messages based on the or-
11 der in which file system transaction entries were stored in the backup memory.